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AIR RESOURCE MANAGEMENT PROGRAM FOR SOUTHWESTERN OHIO-NORTHERN KENTUCKY

Public Health Service
Cincinnati, Ohio

March 1967

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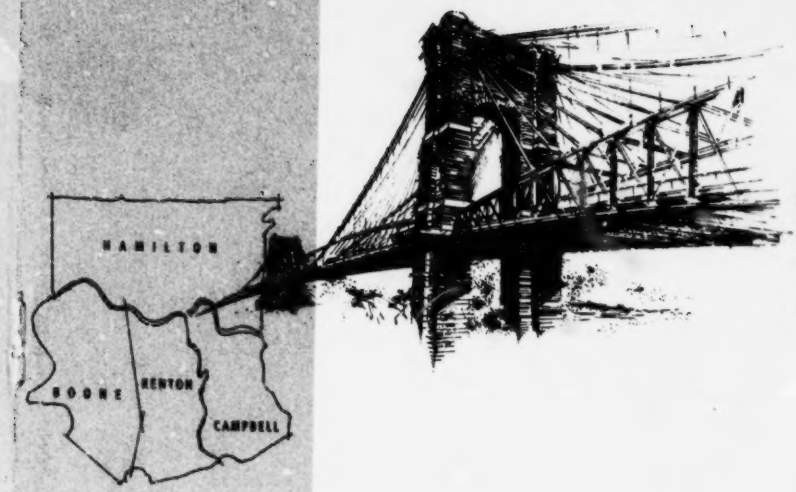

SWO-NK

SOUTHWESTERN OHIO – NORTHERN KENTUCKY
AIR POLLUTION SURVEY

CITY OF CINCINNATI

CITY OF COVINGTON

CITY OF NORWOOD

CITY OF NEWPORT

HAMILTON COUNTY

BOONE COUNTY

KENTON COUNTY

CAMPBELL COUNTY

INTERCOMMUNITY AIR POLLUTION CONTROL PROGRAM

HAMILTON COUNTY MAYORS AND TOWNSHIP OFFICIALS ASSOCIATION

OHIO DEPARTMENT OF HEALTH

KENTUCKY STATE DEPARTMENT OF HEALTH

PUBLIC HEALTH SERVICE

AIR RESOURCE MANAGEMENT PROGRAM

FOR

SOUTHWESTERN OHIO—NORTHERN KENTUCKY

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AIR RESOURCE MANAGEMENT PROGRAM

FOR

SOUTHWESTERN OHIO—NORTHERN KENTUCKY

a report of the
Technical Committee
Southwestern Ohio - Northern Kentucky
Air Pollution Survey

Cincinnati, Ohio
March 1967

This report was prepared and printed for the project Technical Committee by the Control Development Program, National Center for Air Pollution Control, U. S. Public Health Service, DHEW, referred to throughout the report by its previous name, the Technical Assistance Branch, Division of Air Pollution. Copies of the report are available from the cooperating agencies listed on the cover and from the Control Development Program, National Center for Air Pollution Control, 1055 Laidlaw Avenue, Cincinnati, Ohio.

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*The representatives of the governmental agencies were the only voting members of the Technical Committee with the exception of the U. S. Public Health Service, which served in a technical assistance capacity only and did not have a vote.

FOREWORD

More than a million people living and working in the more than 70 political jurisdictions located in four counties in two states share a single air supply and use this same air resource as a dumping ground for aerial wastes. Only half of these people at present support a full-time governmental air pollution control program.

Many municipal services, such as waste collection, fire protection, building regulations, and the like, can be successfully programmed by the individual communities. Air pollution, however, transcends municipal jurisdictions at will. Thus, to be wholly successful, the control of air pollution must be approached cooperatively on a regional basis.

The Southwestern Ohio - Northern Kentucky (SWO-NK) Air Pollution Survey group was organized to prepare a plan for an air resource management program for the SWO-NK region. This has been done by the Technical Committee, the working group appointed by the Executive Committee of the Survey. The program proposed herein represents a majority view of the 12 state and local governmental agency representatives composing the Technical Committee, but does not necessarily indicate acceptance in full by all such representatives. Likewise, Executive Committee acceptance and release of this report do not necessarily commit the governmental units represented on that body; these governments do, however, believe that the proposal contained herein is worthy of serious consideration by the people of southwestern Ohio and northern Kentucky, and by the communities in which they work and live.

ACKNOWLEDGEMENTS

This report, although prepared by Clark Gaulding, Project Co-Supervisor for the Technical Assistance Branch, Division of Air Pollution, U. S. Public Health Service, working at the direction of the project Technical Committee, includes the participation of many others. All agency representatives contributed, several with original ideas and approaches. The individuals who contributed are too numerous to mention by name, but their contributions were in each case significant and important. All should gain a sense of satisfaction from the role this report plays in helping the southwestern Ohio - northern Kentucky area reach its clean-air goals.

Mr. Charles W. Gruber, Air Pollution Engineer for the City of Cincinnati, deserves special mention for his important contributions throughout the survey. Mr. Gruber was instrumental in the initiation of the project, and, as Project Co-Supervisor for the Cooperating Agencies, continually gave the Technical Committee the benefit of his years of experience in the air pollution field.

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I. SUMMARY REPORT

INTRODUCTION

The primary purpose of this report is to assist the citizens and governments of southwestern Ohio and northern Kentucky in understanding the nature of their air pollution problem and in developing a course of action - an air resource management program - to assure desirable air quality both now and in the future. This report culminates over a year of study and effort under the title, Southwestern Ohio - Northern Kentucky (SWO-NK) Air Pollution Survey. The Survey, established by formal agreement on March 31, 1965, brought together a Technical Committee consisting of 12 voting members representing local and state governments in Ohio and Kentucky and several other non-voting members, including the U. S. Public Health Service, industrial leaders, and citizens all acting in an advisory or assistance capacity. They were brought together to consider a problem common to them all and to propose a solution, which, of necessity, must be common to them all.

The entire southwestern Ohio - northern Kentucky area is part of an upland plain about 900 feet above sea level, trenched at least 400 feet by the present and past courses of large, through-flowing streams (Ohio, Miami, Little Miami, and Licking Rivers) and their tributaries. The valleys of these large streams and those not now occupied by streams are 200 to 400 feet deep and 1/2 to 3 miles wide between abruptly rising hills.

The more than a million people who draw from the single air supply of this area live and work in more than 70 political subdivisions of Hamilton County in Ohio, and Kenton, Campbell, and Boone Counties in Kentucky. Some communities of western Clermont County, Ohio, also share this common air supply. An air resource management program that does not encompass all pollution sources, and all receptors sharing a common air supply can achieve only partial success.

In view of this realization and of the many other facts presented later in this report, a proposal is made for a unified air resource management program for the SWO-NK region that will:

- Establish air quality goals for the protection of the health, comfort, and economic well-being of the entire community.
- Develop and maintain an air pollutant emission inventory.

- Provide realistic source emission limitations considering the full impact of those conditions influencing the transport of air pollutants and the air quality goals.

- Establish and maintain an air quality monitoring program and source testing capability.

- Provide engineering advisory services for control of air pollutants.

- Provide air quality goals and emission limitations to be applied in land use planning.

- Establish a regulatory program to foster an equitable sharing of the air resource of the region, utilizing scientific information as the basis for decisions.

A program made up of these elements would develop ambient, or outdoor, air quality goals designed to eliminate those adverse effects judged unacceptable by the community. Based on the ambient air quality goals, standards limiting the emission of pollutants into the air would be promulgated. This is an optimizing procedure whereby desirable air quality is attained with a minimum of control, and it is the basic precept of air resource management.

The procedure just described demands time and specific information, neither of which were adequately available for the SWO-NK Survey. The initiation of the air resource management procedure just delineated should receive top priority if and when a program is implemented. Until such time as this can be accomplished, interim air quality goals and emission standards are proposed for consideration, and existing governmental agencies in the area are urged to consider the adoption of an ordinance embodying the suggested regulations to provide air pollution control until a regional program can be implemented. Although the work carried out by the air resource management program, as proposed herein, may show these interim measures to be inadequate as long-term goals, they were chosen to provide an improvement in air quality over present conditions, and, as such, should be adequate.

The administrative aspects of the program proposal are discussed in some detail in this report. This is commensurate with the relative importance placed on the administrative aspects of the program proposal by the project agreement and by the people involved. The ultimate success of an adopted program in the multi-community SWO-NK region depends much more critically on the adequacy of the organizational framework and basic authority than on any other single aspect. An implemented program can change the technical rules and regulations that it administers more easily than it can change its own basic configuration.

This report also presents a general discussion of the air pollution problem in the SWO-NK area and applies to it the ideal methodology for solving the problem, the air resource management concept. Various aspects of the air pollution problem are summarized from Technical Committee reports to provide background for the program proposal. The current status of control efforts is also covered.

RECOMMENDATIONS

The recommendations of the SWO-NK Survey group are briefly presented in the remaining subsections of the SUMMARY REPORT. For clarification, they are presented in two separate sections, one pertaining to the program proposal and the other to interim measures.

THE AIR RESOURCE MANAGEMENT PROGRAM

To acquire air quality in keeping with the short- and long-term needs and desires of the greater Cincinnati area, a comprehensive air resource management program must be developed. This program must provide the means for making equitable air resource management decisions and for placing in effective operation those measures decided upon. Such a program would consist of the following major elements.

Administrative Organization

An organization must be formed to administer the air resource management program. Geographically, the organization must reflect the intercommunity and interstate nature of the problem by encompassing all sources of pollution and all receptors within the influence of these sources. To meet this criteria, it is recommended that the program serve Hamilton County in the State of Ohio, and Boone, Kenton, and Campbell Counties in the Commonwealth of Kentucky. Clermont County, Ohio, should be invited to consider participation in the program.

Air Quality Monitoring

Air quality monitoring is an indispensable element of the air resource management program. Aside from acting as a measure of the effectiveness of the overall program, air quality monitoring is required to determine long-term trends in pollutant levels, short-term variations, sudden buildup in levels of toxic or

hazardous pollutants, and the variation in pollutant levels with respect to location within the area. The monitoring program should include measurements of at least the following pollutants:

1. Settleable particulates (dustfall)
2. Suspended particulates
3. Sulfur dioxide and sulfation
4. Oxidants
5. Odors.

Appraisal of Effects of Air Pollution

The air resource management concept necessarily involves an understanding of the relationship of air quality to air pollution effects. Until such time as this relationship and its variation from region to region is fully understood, monitoring should be initiated on a continuous basis to determine the effects of air pollution on human health, comfort, and welfare; the soiling and deterioration of materials; decreased visibility; and damage to vegetation resulting from air pollution.

Air Pollutant Emission Inventory

Another essential element of an air resource management program is a current and continuing emission inventory. Knowledge of the types and quantities of materials emitted to the atmosphere is an important adjunct to the air quality monitoring effort. The necessary organization required to gather this information initially and to keep it up to date should be established. Natural sources of pollution, such as weed pollen, should be evaluated in the course of the emission inventory.

Air Quality Goals

Based on the information derived from the activities recommended above, air quality goals should be established. To complete this procedure, however, if properly executed, will take 2 to 3 years from the time the program becomes operational. It is, therefore, recommended that interim air quality goals (listed in Appendix A) be adopted when the regional program is implemented. These interim goals would be used only until the more rigorous air resource management procedure is executed. With the exception of the oxidant goal, the interim goals represent approximately a 25 percent reduction in pollutant levels, based on current air quality data, which is a reasonable goal for the first years of program operation. Consideration of the oxidant goal was brief in view of the likely change in this pollutant level when the national standards on automobile emissions become effective in the fall of 1967. For each of the pollutants listed in Table A.1., two goals

are given for each of five different land- and air-use categories, a "not to be exceeded" goal and a level below which at least 90 percent of the measurements taken during the given time period must fall.

Air Pollutant Emission Regulations

In the air resource management procedure, the establishment of air quality goals can be translated scientifically into pollutant emission regulations, the basis of control and enforcement procedures. Since, again, there will be a 2- to 3-year lag between the initiation of a program and establishment of scientific emission regulations, interim regulations, or standards, are proposed for adoption by the regional program when first implemented. They are more restrictive than those presently in force in Cincinnati and in the Intercommunity Air Pollution Control Program and may, therefore, be considered directionally right, if not quantitatively correct because they will result in cleaner air. The proposed interim regulations are listed in Appendix B.

Planning and Zoning

Air quality must be considered in planning and zoning decisions and programs. The potential effect on air quality levels of planning decisions, as established by application of diffusion theory and other engineering approaches, should be evaluated. Land use should be considered in terms of air use so that every effort can be made to conserve the community's air resource. Local planning agencies should consider the adoption of the proposed emission standards as guides to performance in industrial zones. This would provide a head start on the problem.

Education and Information

Once the air resource management program is established, every effort should be made to inform the people of the greater Cincinnati area of the program objectives and of their roles in accomplishing those objectives.

IMPLEMENTATION AND INTERIM MEASURES

Executive Committee approval of this report fulfills the dictates of the project agreement and thereby officially terminates the Southwestern Ohio - Northern Kentucky Air Pollution Survey. The project was terminated at this point purposely, with full realization that completion of the survey will not result in an action program. On the contrary, the development of the program plan is only the first of several steps required to bring such a program into being. Completion of this report, however, provides a natural pause during which several things must happen.

Action at the State Level

1. Legislation probably will be required at the state level in both Ohio and Kentucky to allow for consolidation of air resource management efforts recommended in this report.

2. An interstate compact will have to be drafted and enacted between Ohio and Kentucky, and it will have to be approved by the U. S. Congress. It is recommended that the legislative research or service commissions of the two states assume a leadership role in the development of required legislation.

These legislative activities at state and federal levels will come about only as a result of local efforts.

Action at Local Level

1. The citizens, community leaders, and elected officials must be aware of the nature of the air pollution problem in the four-county, two-state area and of the solution proposed herein. This report is being given the widest distribution possible in order to accomplish this.

2. An organization, either already existing or formed specifically for the purpose, must foster the subsequent efforts required to establish an active air resource management program.

3. On the basis of the measured response to this program proposal, the above-mentioned organization should:

   a. Further investigate the status of air pollution legislation at all levels of government in both states.

   b. Draft any required state-level legislation needed to permit the development of a single air resource management program in the local parts of the two states.

   c. Draft the interstate compact, which would be the basis of the air resource management program. The compact should establish the administrative characteristics of the interstate air resource management program, the authority vested in it and duties charged to it by the two states, the method by which the program would be financed, and other program elements such as appeal and variance procedures.

   d. Take the necessary steps to bring the drafted legislation before the legislatures of Ohio and Kentucky.

   e. Make continued effort to keep the people of southwestern Ohio and northern Kentucky informed of the progress being made.

4. The regional program should adopt interim air quality goals and emission regulations to serve until scientifically determined goals and regulations can be established on a permanent basis. There will be, at best, a 2- to 3-year lag between now and the implementation of the recommended program. For that reason, existing governments in the southwestern Ohio - northern Kentucky area are urged to consider adoption of local ordinances with provisions embodying the interim emission regulations of this report. Such action would result in a measurable head-start on the management of the vital air resource of the area.

II. AN AIR RESOURCE MANAGEMENT PROGRAM PROPOSAL FOR SOUTHWESTERN OHIO-NORTHERN KENTUCKY

INTRODUCTION

PURPOSE OF THE PROJECT

The project agreement (1) provides that: "The purpose of the project is to develop a comprehensive plan for an air resource management program to control pollution of the single air supply of the southwestern Ohio - northern Kentucky region." Note that the project was a planning function and nothing more; the sum total of the effort was directed ultimately to this report, which is a proposal for an air resource management program, offered to the public officials and to the public for their consideration.

Hopefully, of course, officials and the public will agree on the need for such a program. If so, steps must be taken toward its implementation. Recommendations have been made as to what these major steps should be, and implementation is discussed later in the report.

PROJECT AREA

The project area, and the area on which the proposal is based, includes four counties and the communities within them. They are Hamilton County in Ohio and Boone, Kenton, and Campbell Counties in Kentucky.

PROJECT DEVELOPMENT

Most of man's activities are reasonably managed on the basis of the political boundaries he has established, but his activities leading to pollution of the atmosphere are, unfortunately, an exception. Air pollution is one of the problems of government that is defined by natural rather than political boundaries. The laws of nature that determine the movement of the air and consequently the movement of pollution are unaware that the million-plus people, the 12,000 commercial outlets, and the 1,200 manufacturing establishments in this area are located in no less than 70 separate political jurisdictions, in four counties, and in two states. The whims of nature, over which man has no control, are such that pollutants emanating from a given source easily exert their deleterious effects on residents and property in any one of the other political jurisdictions in the metropolitan area.

This is the background that led to the formation of the Southwestern Ohio - Northern Kentucky Air Pollution Survey. Responsible individuals in this area realized that existing community organizations were not adequate to properly tackle an air pollution problem couched in such technical, geographical, and political complexity.

The City of Cincinnati initiated the survey, and the project agreement was signed on March 30, 1965, after several months of planning. Signatory to the agreement, and thereby members of the Executive Committee, were 12 elected officials representing individual governments or groupings thereof, including:

- The Cities of Norwood, Cincinnati, Newport, and Covington
- The Counties of Hamilton, Boone, Kenton, and Campbell
- The States of Kentucky and Ohio
- The Intercommunity Air Pollution Control Program (IAPCP)
- The Hamilton County Mayors and Township Officials Association (MATO).

The Technical Assistance Branch, Division of Air Pollution, U. S. Public Health Service, was also a party to the agreement, performing in an advisory and assistance capacity. The Executive Committee was charged by the project agreement to form a Technical Committee to which they would either belong themselves or appoint an official representative. The U. S. Public Health Service was a non-voting member of the Technical Committee.

The Technical Committee, which was the working organ of the project, included, in addition to the 12 voting members, a number of invited members representing the industrial community and professional and service organizations, including the Air Pollution Control League of Greater Cincinnati, the Academy of Medicine of Cincinnati, the Northern Kentucky Industrial Foundation, the Campbell-Kenton County Medical Society, and several major industries throughout the SWO-NK region.

The importance of this organizational approach cannot be overemphasized. The major segments of the community with technical capabilities and interest were able to contribute to and have a voice in the deliberations, including the operators of potential sources of pollution - commercial, industrial, municipal, and individual. In addition, the proposal brought forth in this report has been developed in part and reviewed by representatives of the local and state governments.

THE PROGRAM PROPOSAL

The survey project previously described culminated in the development of a plan for an air resource management program. The salient features of the plan are listed below.

ADMINISTRATIVE FEATURES AND ACTIVITIES

1. The program should be based on the air resource management concept.
2. The program should be administered geographically on the basis of the natural air basin that includes Hamilton County, Ohio, and Boone, Kenton, and Campbell Counties, Kentucky.
3. Representation on the administrative policy group should come primarily from the local areas. Because of the interstate nature of the problem, the program must necessarily be based on an interstate compact, which might require minimum state representation.
4. Funds for the operation of the air resource management program should be generated on a local basis, perhaps by use of some already established procedure. Advantage should be taken of any federal or state grant monies available.
5. The administrative group should be vested by the appropriate granting agencies with authority to negotiate directly with potential pollution sources, and, where necessary, to enforce against those sources. Judicial processes and penalties for violation of ordinances or rules and regulations should be established.
6. A mechanism should be provided to allow for the adoption or repeal (through some standard procedure such as open hearings) of rules and regulations necessary to realize the fundamental goals of the air resource management program.
7. Procedures should be established for various other administrative functions, such as hearings, variances, appeals, plan review, and permit or inspection fees (if desired).
8. Reasonable lag time after implementation of the program should be provided for existing equipment to be brought into compliance with adopted emission standards. Some form of local tax relief or other financial incentive might be considered as an inducement to early compliance.

TECHNICAL FEATURES AND ACTIVITIES

1. A continuing air quality monitoring program should be developed. As a part of this program, the effects of air pollution on public health and welfare, property, vegetation, and visibility should be determined.

2. A current and continuing emission inventory should be developed. This is a tabulation of the air pollutant emissions of consequence from any and all sources, including natural sources. Every effort should be made to demonstrate the relationship between geographical density of emissions and air quality.

3. Air quality goals--the air quality sought for the area--should be promulgated. The desirable levels of air quality, including the allowable concentration for each of the pertinent pollutants, should be arrived at through a measure of public attitudes and a study of air quality - effects criteria.

4. A thorough knowledge of the conditions influencing the transport of pollutants should be acquired by program technical personnel. This involves meteorological and topographical factors influencing diffusion characteristics of the air mass. This knowledge will lead to a better understanding of the relationship between actual source emissions and resultant air quality deterioration.

5. Based upon the information acquired from the above and the scientific determinations resulting therefrom, air pollution control decisions and resulting ordinances and emission regulations should be promulgated.

DISCUSSION OF PROGRAM PROPOSAL

AIR POLLUTION BASIN APPROACH

Air pollution is, by its very nature, a complex problem requiring an integrated or "systems" approach to eliminate existing problems and to prevent new ones from developing. The regional plan proposed in this report would eliminate the major obstacle confronting air resource management in an urban area, i.e., the fractionation of governments. The regional program would provide a "unit approach" to the problem by including the geographical area in which the problem runs its course from start to finish--from source to receptor.

INTERSTATE COMPACT REQUIRED

The proposed plan is complicated by the fact that the urban Cincinnati area is interstate in nature, and the program proposed herein would require an interstate compact. Prior to formation of the United States, each of the colonies was considered a sovereign state with the inherent right to enter into treaties with other sovereign nations. This right was relinquished to the federal government when the colonies united. In the almost 200 years since then, a need for formal agreement between states has been recognized in several instances (6) and the "interstate compact" was developed to facilitate such agreements. In effect, when Congress ratifies an interstate compact, the sovereign right of treaty is returned to the states involved for the express purpose stated in the compact.

In spite of the apparent success of some compacts, they are not often used to solve interstate problems. One reason is the considerable time required to initiate the agreement; for instance, the Delaware River Compact took some 20 years from suggestion to implementation, and the Ohio River Sanitation Commission took 10 years. Such delays could probably be shortened, however, as the need for formal agreement between states becomes more apparent.

Another major roadblock to the initiation and to the success of interstate compacts has been the sometimes cumbersome nature of past compacts. Most of them are co-existent with local and state authority and can initiate action only as a last resort. Compacts in this established pattern solve some problems, but are not always effective. To be acceptable to state legislatures and to Congress, an interstate compact should have the potential for being at least as effective, if not more so, as alternative solutions. For interstate air pollution, one of the alternate solutions provided by the Clean Air Act of 1963 (again, only as a last resort) is direct federal abatement. While the federal abatement procedure requires time for notification, investigation, conference, hearing, etc., it does offer the potential for direct corrective measures in interstate areas.

The interstate compact program proposed here has equal or greater potential for preserving the air resource of the area. The proposed organization would not be an additional layer of authority; the local governments of the affected area would vest in the program administrators the authority to manage directly their common air supply. The program would still be responsive to local desires, however, through the mechanism of the commission, made up of appointed or elected officials.

An additional difficulty exists, but not without a possible solution. Most experience with compacts has been in the water pollution field where it is reasonable that the compact cover a specific area, usually an entire water boundary between two or more states. The same is not true for air pollution; the problem is more closely related to urban complexes that might cover only a small portion of the common state boundary, as is the case in southwestern Ohio and northern Kentucky. Because of this situation and because of the desire to have a local, regional program, the two state legislatures would be asked to adopt an interstate compact that would apply to only one relatively small area, with no provision for other separate interstate community air problems (of which there are more than one) along the same border. The end result of adopting this type of compact would be that each time one of the other problem areas along the border attempted a solution through an air pollution compact, they would have to return to the state legislatures for approval. This is a needless duplication at both the local and the state level.

The solution to this problem lies in an innovation of the usual compact format. This innovation would result in a non-specific or "enabling" compact. The State of

Ohio and the Commonwealth of Kentucky, by adopting such an enabling compact, would be saying, in effect, "We recognize that there are potential interstate air pollution problems at more than one point along our boundary, and that each of them is amenable to separate solutions on a regional basis. Under the auspices of this enabling compact, local areas may, at their own discretion, set up interstate air resource management programs capable of solving their air pollution problems. If this is done, the programs would be implemented in accordance with the provisions of this compact." The compact would then detail the procedures and requirements for implementing local, interstate air resource management programs. An administrative commission might be established by the enabling compact to assist in the implementation and operation of local programs under the compact.

Such a solution is logical and problem-oriented. It recognizes that interstate air pollution problems are real or potential; it recognizes that different areas along the state's borders have problems of different magnitudes; it recognizes that existing governmental structures cannot adequately handle the problem; it recognizes that a one-to-one ratio of area problems to area programs is a desirable goal; finally, and most importantly, it recognizes that the decision to implement a program such as that proposed herein is the right and even the responsibility of the people living in the problem area.

Following is a sequence of major events required to establish an air resource management program in the southwestern Ohio - northern Kentucky area based on an interstate compact:

1. The compact agreement would be drafted.
2. Identical forms of the compact would be introduced into the legislatures of the State of Ohio and the Commonwealth of Kentucky.
3. After adoption by both states the compact would be submitted to the Congress of the United States for approval.

Such a compact would very likely define the administrative aspects of the air resource management program to be established under the compact, such as program staff, organization, methods of financing, major operative functions and duties, and other program elements. The SWO-NK Technical Committee did not have the resources to evaluate and made recommendations in all of these areas, but certain of the program aspects were considered.

PROPOSED ORGANIZATIONAL STRUCTURE

Figure 1 is a schematic diagram of the proposed administrative organization.

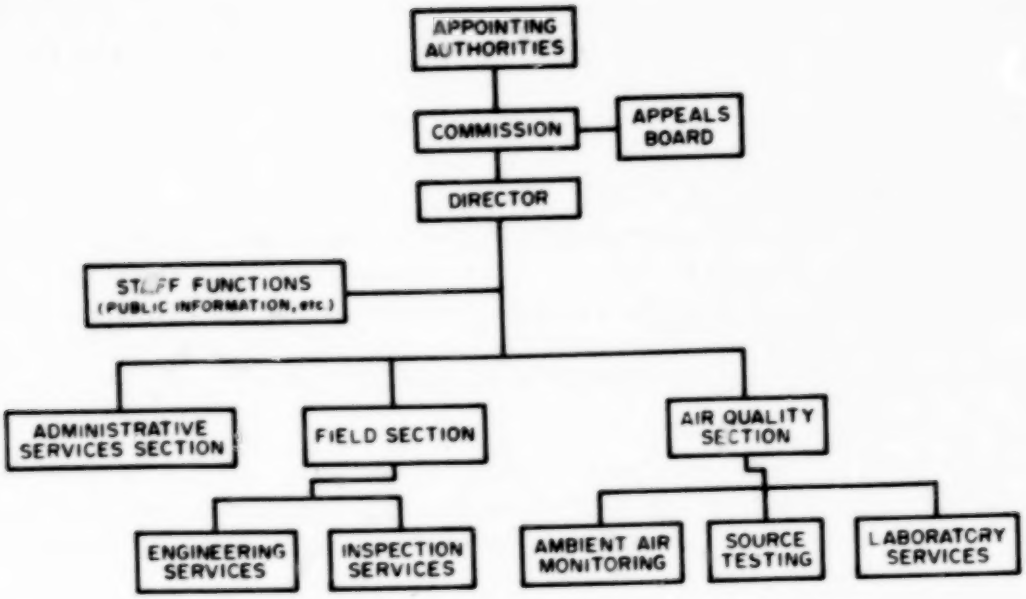


Figure 1. Administrative organization of proposed program.

The major functions of each program element are outlined as follows:

Appointing Authorities - grant appropriate authority and appoint Commissioners. The nature of this function will be established by the interstate compact. As guidance in this area, the following philosophy has been clearly stated by the Technical Committee: the program proposal, though regional in nature, involves a relatively small area, and the authority for staffing the compact commission should be delegated to the existing local governments in that area--the cities and counties. The formula for the distribution of this appointive authority has yet to be established, but the above philosophy would guarantee the critical asset of representation of the affected local area on the governing body of the program.

Commissioners - establish program policy and rules and regulations to accomplish purposes of the Commission.

Appeals Board - a separate group set up to hear appeals on control decisions made by the program Director.

Director - Overall control and direction of the program within the policies established by the Commission.

Staff Activities - General program support, including such items as public information.

Administrative Section - Includes such administrative activities as bookkeeping, financial accounting, and purchasing.

Field Service Section - Would have two units, an Engineering Service Unit and an Inspection Service Unit. The Engineering Service Unit would be responsible for such activities as technical assistance and recommendations for source control, emission inventories, evaluation of technical aspects of program activities and results, and recommendations on the improvement of the technical aspects of the program. The Inspection Service Unit would be responsible for the inspection of sources, investigation of citizen complaints, and field enforcement within guidelines of Commission policy.

Air Quality Section - There would be three units in this section. The Ambient Air Monitoring Unit would operate continuous air-quality and effects-monitoring programs, which would culminate in periodic reports; carry out special studies as needed; and initiate recommendations for the revision of air quality goals when needed. The Source Monitoring Unit would have primary responsibility for source testing activities. In support of this they would develop methods of source testing, if required. The Laboratory and Research Unit would provide laboratory service to the monitoring units and would have primary responsibility for sponsored research activities.

The Appeals Board is shown in Figure 1 as a branch of the Commission, which means that it is advisory to the Commission. The Board would be made up of people with technical capabilities in order that they could make satisfactory decisions on appeals of a technical nature. The two major areas in which they would function would be (1) appeals on decisions of the program Director and (2) appeals for delay in complying with Commission regulations on an individual basis. The decision of the Appeals Board would be used by the Commission in arriving at final decisions and orders. Appeals on the final orders of the Commission would be through the appropriate court and would follow the normal jursidictional procedures of the appellant's jurisdiction.

PROGRAM FINANCING

The exact method of financing a regional program has not been determined. Various means are available for the generation of local funds, but a single method was not chosen as most desirable because of a lack of knowledge of the legal requirements in view of the interstate nature of the proposed program. The possibilities include property valuation assessment, a special district tax levy, and perhaps a per capita levy. An approach easy to justify would be a combination of the property valuation assessment and the per capita levy. Air pollution control is directed toward the protection of man's health and his personal property, and the combination of assessments just suggested would distribute the cost of the program in proportion to the assets of health and property.

At this time, it is impossible to discuss program costs in dollars, primarily because the activities to be carried out are not yet established. Costs can be discussed, however, in relative terms. The Federal Clean Air Act of 1963 established a series of grants to assist local and state areas in the (1) development, (2) establishment, and (3) improvement of their programs. Regardless of which of these three categories is applicable, a grant can be attained for a 3-year period. The maximum ratio of grant money to new local money in a multijurisdictional area such as SWO-NK is 3 to 1.

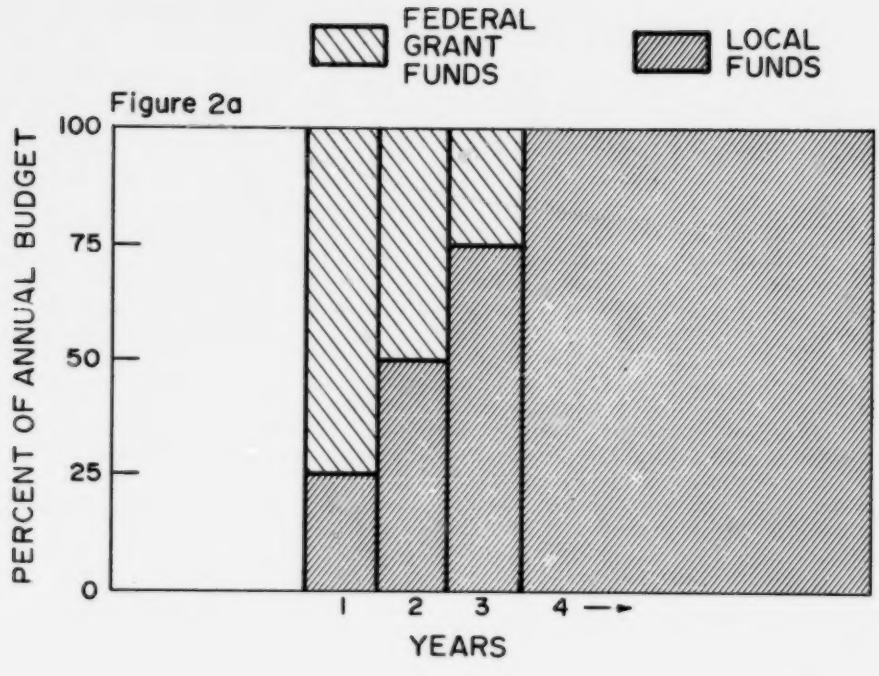
Figure 2 illustrates the possible relationships between local and federal funds. In both 2a and 2b the vertical axis is labeled in percent of annual expenditures. In 2a the ratio of federal to local funds during the first year is the maximum of 3 to 1; in the two subsequent years the ratio tapers down to allow uniform increases in local funding through the grant period to the fourth year when the program would be entirely financed by local funds. Figure 2b illustrates the approach intended by the Clean Air Act. The full 3-to-1 ratio of federal to local funds would be used during the first 3 years of operation, after which a federal "maintenance" grant would be used to partially support the ongoing program. The maintenance grant mechanism was recently established by Congress in amendments to the Clean Air Act of 1963, and it would provide 50 percent of the cost of program operations in those communities where the program met with established criteria.

LEGAL ASPECTS OF PROGRAM PROPOSAL

Existing law in the two states is pertinent to the implementation of the program proposal. The most basic question is, "Will existing statutes allow the formation of multijurisdictional programs for the management of the air resource located entirely within the state (intrastate)?" If the answer to this question is "yes," then a regional, interstate program could be based on the existing legislation plus an interstate compact; if the answer is "no," additional legislation might be needed before the compact can be considered.

The SWO-NK Technical Committee initiated a preliminary review of laws in Ohio and Kentucky in an attempt to answer this question. The Technical Committee minutes record the conclusion reached as a result of the investigation:

> "The status of existing legislation in Kentucky is much more conducive to the development of a four-county, interstate air resource management program than that existing in Ohio. The only governmental level with specific control authority in Ohio is the municipal corporation; the Ohio state program was purposely designed to provide technical assistance only, leaving control authority to lower levels of government, primarily the incorporated and chartered municipalities. The stronger position of the cities (especially the charter cities due to the "home rule" concept)



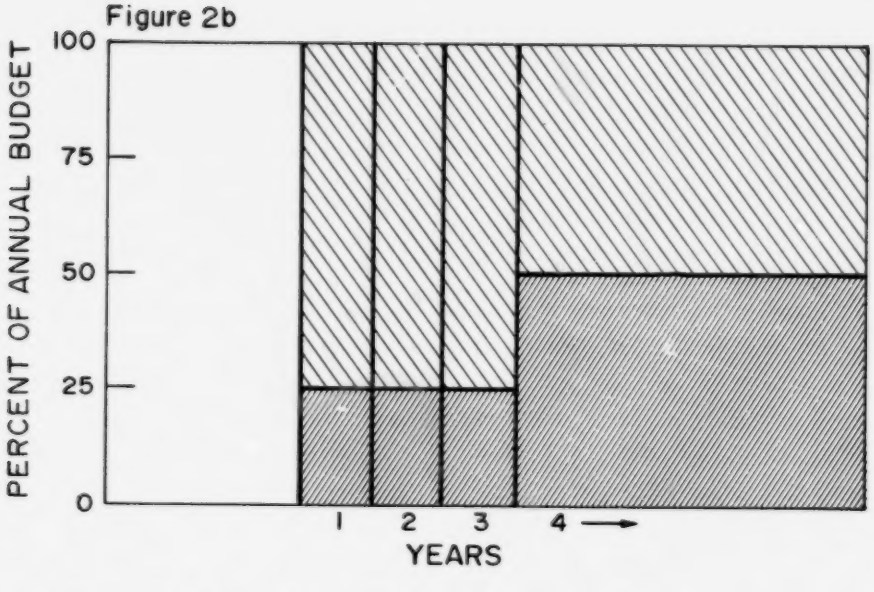


Figure 2. Ratio of local-federal funds during first 3 years.

leaves a rather weak county government in Ohio. County governments can attempt to control air pollution only through the prevention of nuisance or through zoning activities, and these only in the unincorporated portions of the county. While some consolidation and coordination of efforts can be accomplished through legal contracts, the possibility of a stable, permanent, and effective program based on the contract approach does not appear likely.

"In Kentucky, the state has an air pollution control program with regulatory authority. Each county, with action by the county fiscal court (and by the legislative body of first- and second- class cities therein), is the basis of an air pollution control district, also with regulatory authority. Furthermore, Chapter 65 of the Kentucky Revised Statutes might be applied to (1) form a multi-county district and (2) form an interstate compact.

"While the Commonwealth of Kentucky appears to have a more advanced legislative posture with regard to efforts by local governments to enter into inter-governmental agreements on air pollution than does the State of Ohio, it would seem desirable, and possibly necessary, for specific legislation to be enacted by both states to establish an interstate compact which could be applied to the control of air pollution in the southwestern Ohio and northern Kentucky area."

It is recommended that the legislative research or service commissions of the two states, on the basis of this conclusion, the recommendations in this report, and their own evaluation, develop the legislation required to establish a four-county, interstate air resource management program in the southwestern Ohio - northern Kentucky area.

The considerable amount of work that remains to be done raises a question on the decision to terminate the SWO-NK project with the completion of this report. The formers of the project reasoned that the development of the plan itself was a complex task, and that, while the subject is a technical one, the program plan naturally has political and social aspects, all of which must be considered by the communities before the additional steps required for implementation of the plan are initiated.

PROGRAM IMPLEMENTATION

In view of this decision and the assumption that the communities will favor the establishment of the proposed program, a new "organization" must assume responsibility for completion of the additional work and coordination of the efforts required of outside groups, such as the two state legislative commissions. This new organization might be one already in existence that is atune to the program proposal, or it might be a regrouping of interested and dedicated individuals in the area. Although it first appears that the future of the entire project is left in suspension, there is a desirable balance. The implementation and successful operation of the air resource management program proposed herein will require the enlightened desire of the area's residents to guarantee the future of their air resource; if that desire exists or is created by this report, the additional steps will follow.

Considerable time could elapse between the release of this report and the initiation of the air resource management program. There is no need, however, for communities to postpone positive action. The emission standards outlined in this report are available for use at any time by existing local governmental agencies. Their use is recommended especially by local planning agencies, which are in a natural position to prescribe performance standards for industrial areas.

THE THREE "WHYS"

WHY HAVE AN AIR POLLUTION PROGRAM?

Fundamentally, there are two reasons for having a governmental air pollution program: (1) the community's air supply is already deteriorated, and there is a need for corrective action; or (2) although air quality is acceptable at the present time, the potential for a future problem is strong.

No justification is required for a program under the first situation; the problem is there in tangible form. In the second case, however, the need for a program may not be so evident since deterioration of the air mass may not be critical enough to mobilize reaction.

In different terms, the program for the first situation would be curative, and the second, preventive. One of the fundamental concepts of government, regardless of level, is that it should prevent problems wherever possible, and only lastly should it cure them. The thread of prevention can be seen running throughout government in this country. Planning and zoning functions are almost totally preventive. Health department disease vector control and preventive medicine activities are based on prevention. All of the many licenses and permits, such as vehicle safety stickers, have prevention as one of their important features. Even police and fire departments, often considered curative, expend much of their total efforts on prevention of problems. Government does not, however, have a monopoly on prevention--it is a part of everyday life, both at home and at work.

In the realm of environmental problems, a recent publication of the National Sanitation Foundation, titled "Conserving Man's Environmental Resources," confirms the following statement: (3)

> "The difficulties of solving the problems of man's environment are increased immeasurably if the problems are not attacked until they have evolved to a stage of crises. Preventive measures, applied early, are more feasible, effective, and economical for the many environmental problems that are in a pre-crisis stage."

From this, we can conclude that prevention of a future air pollution problem is as valid a reason for an air pollution program as is the solution of an already existing problem.

The question might be asked, "Couldn't pollutant sources take the necessary corrective steps on a voluntary basis, possibly under the guidance of a non-governmental organization?" Voluntary action would be ideal (if it were clear what the necessary steps were), but there is a major difficulty with this approach: voluntary programs regulate the good citizen and let the bad citizen go unencumbered. The good citizen is placed at an economic disadvantage in that he feels compelled by his attitude of community responsibility to comply even though it may represent considerable business expense. The bad citizen, on the other hand, has all of the advantage--he can ignore his responsibility and save his money.

The final argument for an air pollution program comes from industry itself. Those members of the industrial community with an eye to the future consider the reasonable long-range goals and regulations of a control program as guides for their own planning. Far-sighted industry prefers to design to an established, reasonable regulation rather than have a possibly unreasonable regulation established after they are in business.

Industry as a group is often incorrectly prototyped as the sole cause of air pollution and hardly ever as a sufferer from air pollution. This is not the case; a recent survey (4) of over 150 industries in the SWO-NK area revealed that almost half of them considered community air cleanliness as a positive factor in their operations. Another important point came out of this survey: It is often argued that air pollution regulations tend to restrict industrial growth in an area. Over 60 percent of the contacted industries refuted the argument and only 13 percent of them agreed with it. No doubt the reasons for the majority attitude are, in large part, those given above--an actual requirement for clean air by some industries, and a need for workable and reasonable regulations to serve as planning guides for other industries. In total, the survey demonstrated an understanding of the problem on the part of the industrial community and a willingness to assume a major role in finding the answer.

WHY AN "AIR RESOURCE MANAGEMENT" PROGRAM?

There is more than just a difference in terminology between an air resource management program and an air pollution control program. An important and basic difference exists in the underlying philosophies of the two. In times past, the control of air pollution has been based primarily upon the correction of existing problems by regulatory control on a "best practicable means" basis, meaning that pollutant emissions should be controlled to the extent that it is "practical" to do so. Unfortunately, this approach can easily lead a community and its industry astray in one of two directions. The installation of improved controls in an existing or new plant may, by showing an improvement in the best practicable means, serve to escalate the emission standard, thereby adding to the cost of existing

and subsequent plants (5). The resultant improvement in air quality may or may not be needed or wanted by the community. On the other hand, lack of improvement in control technology could result in the continued or increased emission of a pollutant in spite of community requirements and demands that it be reduced.

The air resource management concept ideally prevents either of these extremes. The air supply of a region such as SWO-NK is considered a resource that has definite limits under certain situations and it must, therefore, be conserved in order to meet all demands for its use. Thus, based on the need for the programmed use of the air resource, this concept holds that there is an optimum balance between conflicting demands for air use and that this balance can be objectively and scientifically determined and maintained. The air resource management concept is, then, an optimizing procedure in which the two major conflicting uses - air as a means of waste disposal and air as an environment - are reconciled with a minimum of control.

WHY A REGIONAL PROGRAM?

The answer to this question is perhaps the most important of all, and is based on the air resource management concept and a basic understanding of the physical nature of the atmosphere. An analogy is useful at this point: assume an area with communities A and B located across the river from each other; community A treats wastes before discharge into the river, but community B does not. The difference in treatment is irrelevant 1 or 5 miles downstream; the facts are that the water has mixed and a degree of pollution exists in the river. Is it fair that Community A should carry full responsibility for maintaining the acceptable quality in the water resource? The answer, of course, is "no"; both communities benefit from the use of the river, and both, thereby, incur a responsibility for the condition of the resource after its joint use.

This analogy has defined a situation in which a logical geographical unit exists for the conservation of a natural resource, in this case, a river. The logical unit is the river itself and all of its users located in the drainage basin. This logic can be applied to the use and conservation of the air resource, as well. In fact, the need for shared responsibility is even greater because of the additional degrees of freedom in the movement of an air mass; there is no consistent "downstream" in the transport of air as there is in the movement of water. The three-dimensional freedom of air movement makes the logical geographical unit harder to define, but increases the common interest of contiguous communities. A community that today is a source of pollution affecting its neighbors may, with a change in the wind, see the situation reversed tomorrow.

For lack of better delineation, the urbanized area around and including Cincinnati was chosen as the logical geographical unit (or "air basin") for the application of an air resource management program. With the boundaries extended to the

the outer reaches of Hamilton County in Ohio, and Boone, Kenton, and Campbell Counties in Kentucky, all major sources of pollution and all probable receptors are within the bounds of the program.

III. THE AIR POLLUTION PROBLEM

INTRODUCTION

Air pollution is a complex problem involving to varying degrees almost all activities of an urbanized area. The sources of pollution are not all stationary, nor do they all emit the same pollutants in constant amounts. The ability of the atmosphere to assimilate and disperse the large quantities of material released into it is constantly changing. The relationship between air quality levels and resulting effects varies, depending on the pollutant being considered and the condition of the things and individuals affected.

All of these variable factors contribute to the complexity of the air pollution problem and make it difficult to explain and even more difficult to solve. In a much simplified explanation, source emissions (as modified by meteorology) result in deteriorated air quality and subsequent undesirable effects. Figure 3 shows this simplified relationship and the effect on the overall picture of variations in some of the factors. Starting at the lower left, three quantities of pollutant emissions are depicted, ranging in non-quantitative terms from low to high. In the transition to air quality, each of these emission levels is modified by good-to-bad meteorological conditions, so that the result is a broadened spectrum of air quality levels. Note that a higher level of emissions under good meteorological conditions could conceivably result in better air quality than a lower emission level modified by bad meteorological conditions. For average meteorological conditions, however, successively higher emission quantities result in successively greater deterioration of air quality. Going on, the range of good-to-bad air quality (as determined by both of the preceding factors) leads directly to a similar range of air pollution effects.

This, in simplified terms, is the air pollution problem. Before looking at some of these individual factors as they exist in the SWO-NK region, consider the idealized procedure by which the problem is solved. Referring again to Figure 3, the range of effects shown on the right will result in some level of public awareness. Depending on the severity of the problem (the position of a community on the "effect spectrum"), the level of public awareness and concern may lead, through a process similar to that preceding the SWO-NK survey, to a value judgment and a community decision. In Figure 3, the position of the community decision says, in

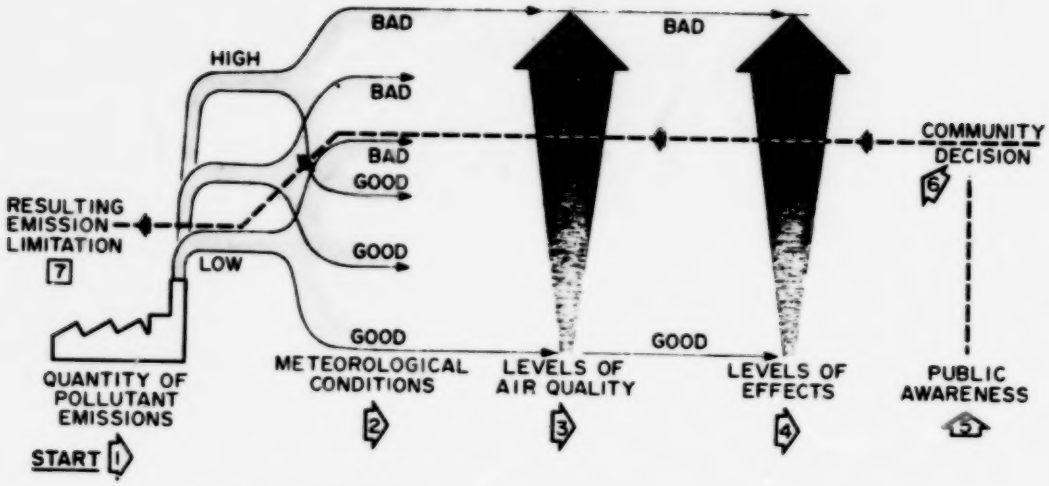


Figure 3. Factors involved in air resource management.

effect, "We will not tolerate air pollution effects above this level." The level of the community decision based on effects (dotted line) says, in turn, that deterioration of air quality shall not go beyond a certain limit, which leads to an emission limitation. The emission limitation says, in effect, "The emission of pollutants in quantities below this level is acceptable to the community, in that it will not violate the effects - air quality goal, even when modified by 'bad' meteorological conditions."

THE PROBLEM IN SOUTHWESTERN OHIO - NORTHERN KENTUCKY

The major elements of an air pollution problem have been related to each other in qualitative terms and for a non-specific situation or area. Various aspects of the problem in the southwestern Ohio - northern Kentucky area were studied early in the project, and the results were presented to the Technical Committee in the form of working documents. The information contained in those reports is summarized here to provide background for the program plan.

SOURCES AND QUANTITIES OF POLLUTANTS

The emission inventory for southwestern Ohio - northern Kentucky (6) included estimates of the annual emissions, in tons, of five major pollutants: solid or particulate material, sulfur dioxide gas (SO_2), nitrogen oxide gases (NO and NO_2), total hydrocarbons, and carbon monoxide. The scope of the project did not allow the estimation of other pollutant emissions such as sulfuric acid mist or any of a host of odorous compounds, which are equally as important as the five major pollutants listed in the emission inventory. As an example, the term "air pollution" is more often related by the residents (7) and the officials (8) in the area to "unpleasant odor" than to any other characteristic. The data collected, therefore, represent

only a part of the problem.

Pollutants result either from the inefficient use of raw materials and fuels or the inefficient collection and disposal of the unusable portions of materials and fuels. Based on this information the quantities of pollutant emissions can be estimated by using available data on the quantities of the fuels, raw materials, and refuse handled in the area. Tables 1, 2, and 3 tabulate estimated annual quantities of these materials, and Table 4 presents the resulting estimates of annual and daily pollutant emissions. Note that industrial processes are not included.

These pollutant estimates are for the entire area, and indicate nothing about distribution within. A rapid technique was devised, as reported in the emission inventory, whereby the estimated emission of each pollutant (see Table 4) was distributed geographically in proportion to the level of activities responsible for the various emissions. Two of the resultant distributions are shown here in Figures 4 and 5 to illustrate the results of this process. The data in these two figures,

Table 1. ESTIMATED ANNUAL FUEL CONSUMPTION - STATIONARY SOURCES

Source category	Type of fuel		
	Coal tons	Oil, gal	Gas, ft^3
1. Steam-electric utilities	2,920,000	710,000	
2. Industry[a]	874,000	13,500,000	21×10^9
3. Commercial	660,000	8,300,000	16.9×10^9
4. Domestic	70,000	27,500,000	45.3×10^9
Totals	4,524,000	50,010,000	83.2×10^9

[a]Estimate of total fuels purchased, including fuel used for heat in process operations

Table 2. ESTIMATED ANNUAL VEHICLE FUEL CONSUMPTION AND SOLVENT USE

Type of fuel	Quantity, gal
1. Gasoline	340,000,000
2. Diesel	7,000,000
3. Evaporated gasoline	7,000,000
4. Solvents	650,000

Table 3. ESTIMATED ANNUAL AMOUNTS OF COMBUSTIBLE REFUSE

Method of disposal	Quantity, tons
1. Municipal incineration	
With control	16,600
Without control	333,400
2. Private incineration	50,000
3. Open burning	50,000

Table 4. ESTIMATED AIR POLLUTANT EMISSIONS[a], SOUTHWESTERN OHIO - NORTHERN KENTUCKY

Pollutant	Yearly emissions, tons	Average space-heating day, tons/day	Maximum space-heating day, tons/day	Minimum space-heating day, tons/day
Particulate	65,000	180	230	140
Sulfur dioxide[b]	190,000	520	620	445
Nitrogen oxides (as NO_2)	69,000	190	220	160
Carbon monoxide	517,000	1,420	1,370	1,450
Hydrocarbons	136,000	370	365	375

[a]Does not include industrial process emissions and various miscellaneous sources such as demolition fires, construction work, aircraft and railway operations, and other sources that might occasionally emit significant amounts of pollutants.

[b]Sulfur dioxide emissions were calculated on the following basis: 2% sulfur in industrial and steam-electric coal; 0.8% sulfur in domestic and commercial coal; 1.4% sulfur in industrial and steam-electric fuel oil; 0.3% sulfur in domestic and commercial fuel oil.

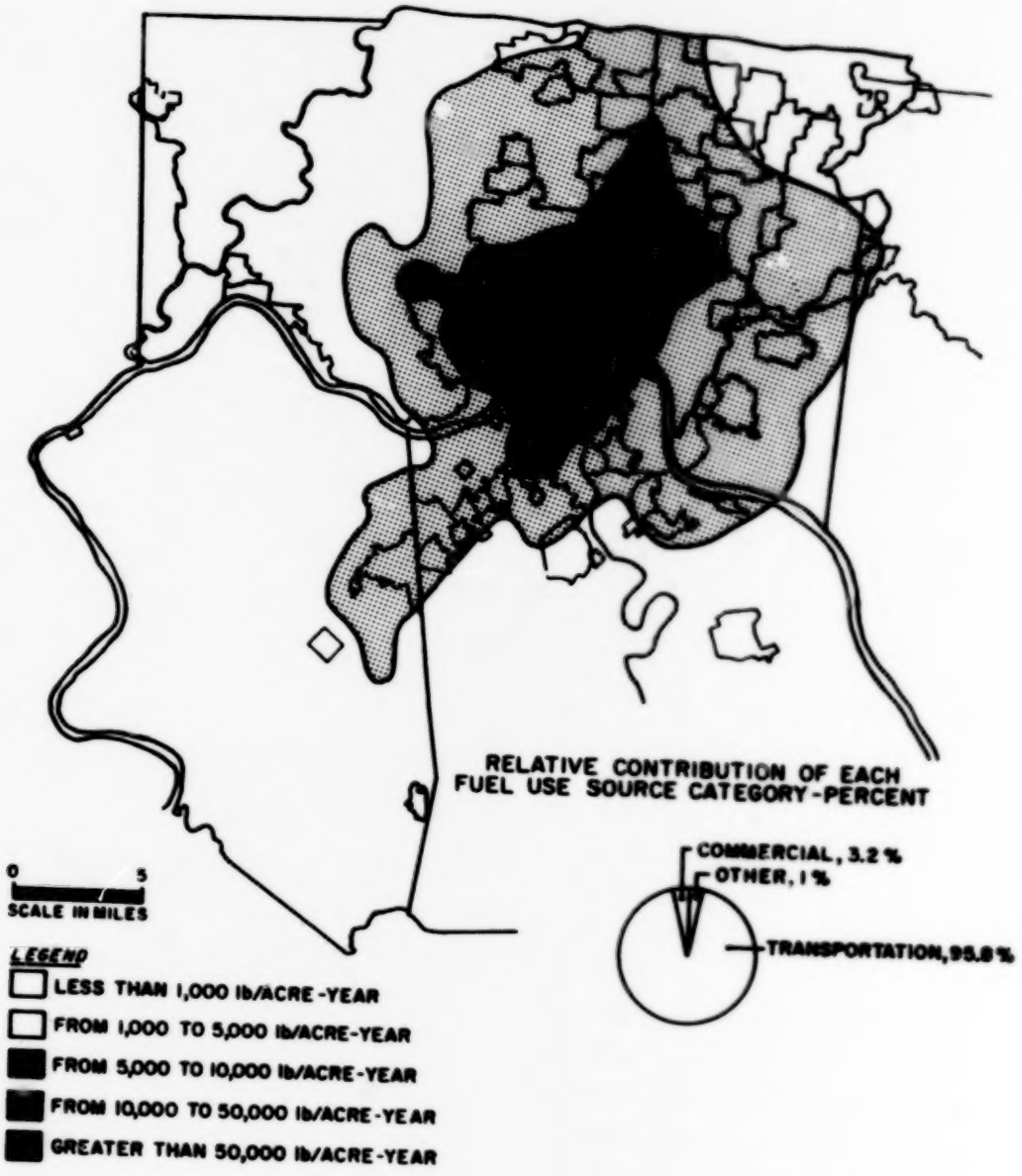


Figure 4. Estimated carbon monoxide emission density - assuming uniform air pollution control regulations throughout the area.

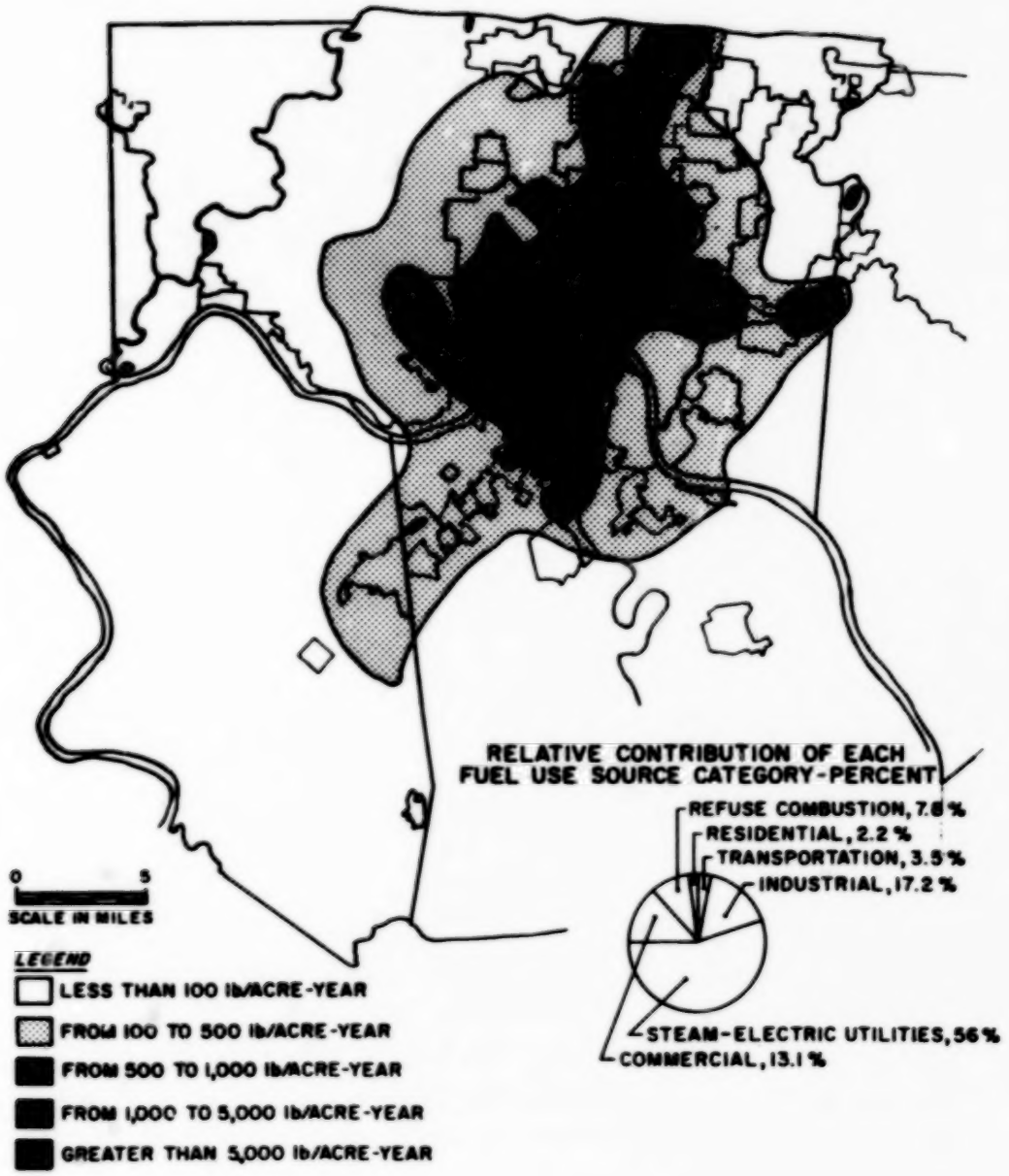


Figure 5. Estimated total particulate emission density - assuming uniform air pollution control regulations throughout the area.

along with similar data on emissions of the other three major pollutants provided the basis for the emission inventory report, the conclusions of which are summarized here.

1. The purpose of a short-term emission inventory, such as this, is to provide general, accurate-as-possible estimates of pollutant emissions for a given area. A more comprehensive inventory for the SWO-NK area should be executed as soon as the means become available.

2. Estimates of annual fuel-use figures for the SWO-NK area are as follows: 4.5 million tons of coal, 50 million gallons of fuel oil, 83 billion cubic feet of natural gas, 340 million gallons of gasoline, and 7 million gallons of diesel fuel. About 600,000 tons of combustible refuse is produced in this area each year, of which approximately 350,000 tons is municipally incinerated, 50,000 tons is disposed of by private incinerators, and 50,000 tons is open-burned. The remainder, 150,000 tons per year, is landfilled, dumped, or hauled out of the area.

3. Without accounting for industrial process emissions and various miscellaneous sources, an estimated 180 tons of particulate, 520 tons of sulfur dioxide, 190 tons of nitrogen oxides, 1,420 tons of carbon monoxide, and 370 tons of hydrocarbons are emitted into the atmosphere on an average day.

4. Industrial processes, not included in this inventory, would be expected to contribute substantial quantities of some pollutants, especially particulates. Other emission inventories (6) indicate that particulate emissions resulting from industrial processes make up varying percentages of the total particulate emission; these percentages range from almost zero to about 50 percent for highly industrialized areas. If industrial processes and other unaccounted-for sources of particulates in the SWO-NK area are assumed to contribute 40 percent of total particulates, the total emission of particulates from all sources for an average day would be estimated at approximately 300 tons per day.

5. Emissions of particulate and sulfur dioxide are strongly dependent upon the amount of fuel used for space heating. As an example, particulate emissions vary from an estimated 140 tons on a minimum space-heating day to 230 tons on a maximum space-heating day, with an average of 180 tons per day.

6. Automobiles are the principal source of carbon monoxide and hydrocarbons. Although fairly constant throughout the year, the emission of these two pollutants shows a slightly lower trend in winter and a higher trend in summer because of the seasonal fluctuation in vehicle traffic.

7. The emission-density maps indicate that industrial areas and high-population-density areas have the highest emissions on a pounds-per-acre basis.

8. If the discontinuity of the Ohio River is ignored (as it was in drawing the emission density isopleths), emissions show a general disregard for municipal, county, and state boundaries. This suggests that control of these emissions would be most reasonably accomplished through some form of cooperative action.

METEOROLOGICAL AND OTHER FACTORS

The atmosphere is the medium by which air pollution is transported from the source to the receptor. Thus, for a given source strength, the action of the atmosphere governs the length of time, the frequency, and the pollutant concentration to which any receptor will be exposed. An analysis of weather conditions and climate is, therefore, of major concern in any evaluation of an air pollution problem and its prevention and control. Nearly all facets of the climate of an area contribute, either directly or indirectly, to the air pollution dispersion potential of that area. Factors discussed in the SWO-NK Technical Committee report (9) are wind speed and direction, atmospheric stability, and solar radiation; the diurnal, seasonal, and geographical variations of these meteorological factors are discussed in some detail.

The predominant annual wind direction is southwesterly, and the average annual wind speed is 9.6 miles per hour. This is, however, the large-scale condition; wind speed varies considerably within the area, depending primarily on local topographical conditions. Figure 6 shows the principal topographical features of the SWO-NK area - an upland plain, irregularly trenched by the past and present courses of through-flowing streams and their tributaries. The channeling effect of the various valleys is predominant in determining the direction and speed of low-level air movement, with the prevailing directions up and down the valleys and the wind speed lower than the large-scale wind speed.

These factors contribute to the increased stability of air in the low-lying areas and the increased potential for pollutant buildup. Hilltop locations, less susceptible to high air-pollution concentrations, experience serious pollution primarily during periods of large-scale stagnation and for brief periods after the morning breakup of valley inversions (stagnations).

Evaluation of the combined influence of the individual meteorological parameters indicates that atmospheric conditions in the SWO-NK area are most conducive to high pollution concentration during summer and fall. During these seasons lower wind speeds, fewer frontal passages, and more frequent cases of prolonged stagnation prevail and less cloudiness permits more photochemical reactions, which result in the hazy condition termed "smog".

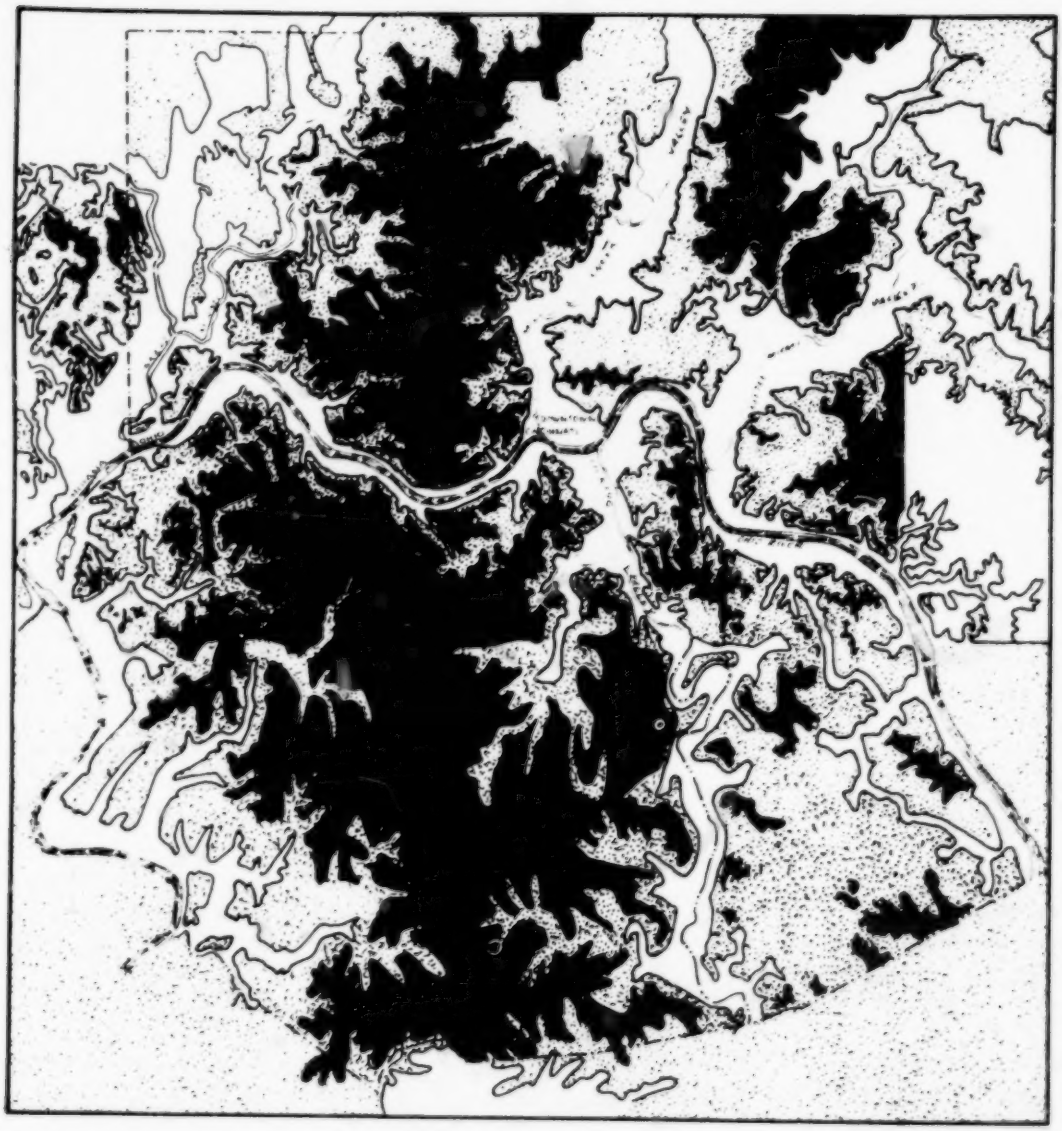


Figure 6. Topography of S&O-SK Survey area.

AIR QUALITY AND POLLUTION EFFECTS

The preceding factors are of concern only as they produce a deterioration in air quality and resultant undesirable effects. All available reports on air quality monitoring in the area were reviewed in the preparation of the Technical Committee report on the subject (10). Data were available on suspended particulate matter, dustfall, soiling potential, and several gaseous pollutants.

Suspended particulate matter, finely divided solid material, is emitted from most fuel-burning activities, industrial operations, and vehicles to a lesser extent. It is responsible for visibility reduction and soiling; it is also thought to be a factor affecting health. Sulfur dioxide from combustion operations and from some industries causes corrosion, damage to vegetation, and damage to health. Carbon monoxide, primarily from the automobile, has well-known effects on human health. The automobile and combustion processes are the major sources of nitrogen oxides, which, besides having some effect on health, are involved in the production of photochemical smog. This phenomenon involves the complex reaction in the atmosphere of the nitrogen oxides with hydrocarbons, in which secondary pollutants are formed. Smog reduces visibility, irritates the eyes and respiratory tract of people, and damages property and vegetation. Hydrocarbons are emitted from cars, inefficient refuse burning, and evaporation of commercial and industrial solvents and gasoline.

There is a long list of additional pollutants of equal or greater importance than some of those mentioned. Odor is a major problem in the SWO-NK community, especially in the outlying areas. Table 5 compares complaint records for the City of Cincinnati with the eight municipalities in the Intercommunity Air Pollution Control Program for the year 1965 (6). Fifty-three percent of the complaints in the eight communities involved odors as compared with only 4 percent within the City of Cincinnati.

Table 5. OFFICIAL COMPLAINT RECORDS FOR 1965 (SEE REFERENCE 6)

Area	Total complaints	Odor complaints	% of total
City of Cincinnati	595	24	4.0
Intercommunity Air Pollution Control Program[a]	261	138	53.0

[a] In 1965, members were: Lockland, Glendale, Elmwood Place, Reading, St. Bernard, Wyoming, Amberley Village, and Arlington Heights.

Odor was also the most-often-named characteristic when community officials were asked to define the term "air pollution" in the Official's Opinion Survey (7), a report of the Technical Committee.

Study of the considerable data available on air quality in the urban Cincinnati area resulted in the following conclusions:

1. Suspended particulate and dustfall levels within the area exceed a number of the standards and goals adopted by various state and local governments.

2. The suspended particulate mean value at the NASN* Cincinnati station was slightly higher than the all-city mean of the 19 NASN cities of equivalent size (400,000-700,000 population), but the difference may not be statistically significant. Of more significance is the fact that the slope of the curve for frequency of occurrence of various concentrations in Cincinnati is less than the slope of the all-city NASN curve. This may be interpreted as meaning that clean days in Cincinnati are worse than clean days for the whole group (averaged), and, by the same token, dirty days in Cincinnati are better than dirty days for the 19-city group.

3. The levels for suspended particulates, dustfall, and soiling index are considerably higher in the heavily used basin area than those in the higher-elevation surrounding areas.

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4. The concentrations of several pollutants, after significant reductions during the period 1948 to 1956, have leveled off in recent years.

5. The average concentration of SO_2 is not high compared to that of other cities in the CAMP** network. Estimates for 1962-1963 indicate, however, that 0.3 ppm, the taste threshold for SO_2, was reached for eight 1-hour periods each year.

6. Eye-irritating photochemical smog has been measured occasionally in the survey area. The concentrations of the hydrocarbons and oxides of nitrogen involved in the formation of this type are sufficiently high that the coincidental occurrence of increased sunlight and a period of stable atmospheric condition could result in still worse episodes.

7. Although data on odor are scarce, certain portions of the survey area, especially portions away from the central core area, are subject to odor problems.

8. An air quality measurement program covering the entire southwestern Ohio - northern Kentucky area is needed, not only to monitor air quality characteristics generally, but also to evaluate in adequate detail the problems affecting limited portions of the area.

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*NASN is the U. S. Public Health Service's National Air Sampling Network (11)
**CAMP is the U. S. Public Health Service's Continuous Air Monitoring Program (12)

A recurrent fact in the data and conclusions, presented briefly here and in considerably more detail in the referenced reports, is that the sources of pollutants are located essentially without regard to community boundaries. These non-community-oriented sources, when modified by meteorological and topographical factors, produce a truly regional problem requiring a regional solution. This is not a new or original concept; the National Association of County Officials in 1961 made this policy statement (13):

> "The National Association of County Officials (NACO) recognizes the need for air pollution control on a county or multicounty basis.... The laws of many states do not now permit the county or multicounty approach to the abatement of air pollution, a problem which does not respect political boundaries. NACO therefore urges state legislation that will enable individual counties or groups of counties to control their air pollution problems within one state or on an interstate basis in accordance with their needs."

WHAT HAS BEEN DONE - A HISTORICAL REPORT

Air pollution is not a new problem in the SWO-NK area. Before and even after the turn of the century, smoke from industrial and residential smokestacks poured out across the city except during periods of economic adversity. Vigorous smoke-abatement activities made smoke, as a sign of prosperity, a thing of the past in Cincinnati. The City of Cincinnati was the second city in the nation to have a regulatory smoke ordinance; this was passed in 1903. The modern era of air pollution control in Cincinnati began in 1947 when the present code was enacted. Ninety percent of the visible smoke emissions has been eliminated since 1947, and the fallout of grit and airborne ash and dust has been reduced by 14,000 tons per year (14), a 66 percent reduction. These reductions were primarily due to the active enforcement program, which included regulations on the quality of solid fuel, a major shift from solid fuel to gas for space heating, and the application of control equipment to the larger combustion sources.

The city's program involves annual inspections, permits, air quality monitoring, observation patrols, and complaint answering, among other activities.

In 1957, the city passed an ordinance that prohibits the operation of motor vehicles with excessive emission of smoke or vapors. Because of this ordinance, 1240 cars were refused safety stickers in 1965. This was approximately 1 percent of all cars inspected in that year (6).

The Intercommunity Air Pollution Control Program (IAPCP) was formulated in 1957. The City of Cincinnati agreed by separate contract to provide certain services to neighboring communities. The services include observations of visible

smoke violations and notifications of violations, answering citizen complaints, industrial plant inspections, and recommendations for corrective measures where unsatisfactory conditions exist.

Seven communities are currently in the IAPCP: Lockland, Glendale, Elmwood Place, Reading, St. Bernard, Wyoming, and Arlington Heights. Over $1 million has been spent by industry in those seven communities for control equipment since the inception of the program.

An additional program with a long history in the Cincinnati area is the Air Pollution Control League of Greater Cincinnati. Originally named the Smoke Abatement League of Hamilton County when established in 1906, the League is a non-governmental, non-profit, civic organization with financial support from the Community Chest and interested individuals, citizens' organizations, and cooperating industries.

The primary purposes of the Air Pollution Control League are (14):

1. Public information and education.
2. Assistance to and coordination of governmental and other programs.
3. Elimination of air pollution.

The League has carried on a long battle against one of the most prevalent natural air pollutants, ragweed pollen. The pollen is held largely responsible for causing or worsening some 60,000 cases of asthma and hay fever in the Cincinnati area. Cincinnati and Norwood have responded to this program by passing weed control ordinances.

In the recent past, and as a direct result of the Southwestern Ohio - Northern Kentucky Air Pollution Survey, the Air Pollution Control League cooperated with the Engineering Society of Cincinnati and the Greater Cincinnati Chamber of Commerce in the conduct of an Industrial Questionnaire (4). In addition to pointing out industry's progressive attitude concerning the need for air pollution regulation, the survey indicated that some $9 million has been spent by industry on air pollution control equipment in the Cincinnati area since 1960.

All these activities are signs of progress in the areas of the SWO-NK region that have supported air pollution control; those responsible for past successes agree, however, that the total job is not done. Manufacturing is growing in volume and complexity, thus the real and potential air pollution problems are also increasing. Hamilton County's automobile population has more than doubled since 1947. The population of the area especially in suburban communities continues to grow, and pollution naturally grows with it. The efforts of the past must be continued, and

all, not just half, the people of the region must support the program. The cooperation of existing air pollution agencies in the development of this report is proof of the demand for additional efforts.

THE FUTURE AND PROGRAM IMPLEMENTATION

The "value added" of manufacturing in the SWO-NK area increased about $494 million during the 1950-60 decade, and there is every indication that this growth will continue (15). The 1950-60 growth resulted in 20,800 new manufacturing employment positions. A significant feature of the area's manufacturing is the high percentage of growth-potential industries; some 69 percent of all manufacturing positions are in this category.

Well-diversified manufacturing activities are not the only positive note in SWO-NK's future. The area has a strong position in wholesale trade, being well situated with respect to other economic centers, particularly the manufacturing belt and the growing South. These and many other positive factors have resulted in an estimate that total employment in the SWO-NK area will rise from 469,000 in 1960 to 735,000 in 1985, an increase of 57 percent.

Population of the four-county region is expected to increase from 1 million in 1960 to 1.7 million in 1985. The largest percentage increase is expected to occur in Boone County, and the largest growth in actual numbers of people, in Hamilton County.

Recent trends in industrial land use have been toward expansion northward from the City of Cincinnati up the Mill Creek Valley. This expansion has not been duplicated to the south of Cincinnati, but several factors such as increased use of river transportation, the Interstate 75 expressway, the Greater Cincinnati airport, railroad transportation, and the planned circle freeway are all excellent enticements for the growth of northern Kentucky. The new industrial park in Florence, Kentucky, is proof of the growing attractiveness of this area.

Urban development is an additional facet of the community's future. The four largest cities in the SWO-NK area are actively involved in progressive programs of urban development and are investing approximately $300 million, including both local and federal funds, in the future of the area.

All these growth factors have direct implications and bearing on the intended goal of the SWO-NK project--the implementation of a comprehensive air resource management program. The expected growth in industrial and commercial activities and the related growth in population mean only one thing: the potential for air pollution will also increase, and it will increase on the same area-wide basis as the factors previously mentioned. In the face of such growth, protection of the material and human investment from air pollution effects can only be accomplished through

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comprehensive air use planning done in advance. The elimination of existing conflicts in air-use is almost minor in comparison with the opportunity to avoid costly conflicts in the future.

The program plan presented in this report has the potential for meeting the complex demands placed on the air environment of southwestern Ohio and northern Kentucky. The program will not, however, bear fruit of managed air-use until it is implemented; in fact, the results of the program will not become apparent for several years after it becomes an integral part of local government. This is all the more reason for urgency.

The air-use conflicts that arise from man's competing biologic, esthetic, and economic needs are most desirably resolved by the citizens of the affected area. The air resource management concept offers such a possibility in that the ultimate decision on the quality of air in an area rests with the citizens involved. The residents of southwestern Ohio and of northern Kentucky are now confronted with an opportunity to make such a decision. There is little doubt that the future of the community rests, at least in part, on this decision.

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APPENDICES

Appendix A. PROPOSED INTERIM OR TEMPORARY AMBIENT AIR QUALITY GOALS FOR SWO-NK AREA

Pollutant goals	Land use category[a]				
	A	B&C	D&E	F	G
Suspended particulate, g/m^3					
Not to be exceeded on a 24-hour basis	100	150	200	250	100
90% of measurements taken over year to be less than	75	125	150	175	75
Total settleable particulates, $tons/mi^2/mo$					
Not to be exceeded (30-day basis)	20	25	40	50	15
90% of measurements taken over a year to be less than	13	18	25	35	10
Soiling index, $ruds/ft^2/1{,}000\ ft^3$					
Not to be exceeded on 30-day basis	1.2	1.5	2.0	2.5	1.1
90% of measurements taken over a year to be less than	1.0	1.3	1.8	2.2	0.9
Sulfur dioxide, ppm					
Not to be exceeded on 1-hour basis	0.25	0.30	0.40	0.50	0.20
Not to be exceeded on 24-hour basis	0.10	0.13	0.18	0.20	0.08
90% of all measurements taken over a year to be less than	0.02	0.03	0.05	0.06	0.01
Oxidant[b], ppm					
Not to be exceeded on 1-hour basis	0.15	0.15	0.15	0.15	0.15
Not to be exceeded on 24-hour basis	0.10	0.10	0.10	0.10	0.10
90% of all measurements in any 1 month to be less than	0.07	0.07	0.07	0.07	0.07

(continued, next page)

PROPOSED INTERIM OR TEMPORARY AMBIENT

AIR QUALITY GOALS FOR SWO-NK AREA

Pollutant goals	Land use category[a]				
	A	B&C	D&E	F	G
Odors[c]					
Not to be exceeded (for more than 15 min. in any hour)	4	4	4	12	4

[a]Zone A - Residential with 10 dwelling units or less per acre, but nonrural; or recreational areas such as parks.
Zone B - Residential with more than 10 dwelling units per acre; considered high density.
Zone C - Commercial, such as a neighborhood shopping district.
Zone D - Commercial, such as a central business district.
Zone E - Industrial with low air pollution potential.
Zone F - Industrial with air pollution potential.
Zone G - Rural, one dwelling unit per 5 acres or larger area.

[b]Measured by neutral KI method.

[c]Measured by number of dilutions with odor-free air to bring odorous air to threshold of perception.

Appendix B. PROPOSED INTERIM OR TEMPORARY EMISSION REGULATIONS FOR SWO-NK AREA

Particulate Emissions from Stationary Fuel-Burning Equipment

It is recommended that consideration be given to a proposal adopted by a committee of the American Society of Mechanical Engineers (ASME) for the control of particulate emissions from fuel-burning equipment. The ASME proposal reflects plant size, stack height, and downwind concentration and recognizes that good engineering practice can eliminate the emission of any particles larger than 60 microns (about 0.002 inch).

Particulate Emissions from Process or Manufacturing Operations

It is recommended that a regulation be adopted that would relate to ground-level concentrations (to air quality goals) as long as opacity regulations are not violated. Relating emissions to ground-level concentrations is difficult because many factors must be considered. The following schedule of allowable particulate emissions in pounds per hour, related to physical stack height, is recommended as a basis upon which this might be done.

Physical stack height, ft	Allowable emissions, lb/hr
0-50	4
75	10
100	17
125	27
150	40
175	53
200	68
225	88
250	110
275	130
300	160

It is further suggested that in the case where particles emitted are essentially less than 1 micron in size, compliance with opacity regulations be accepted as compliance with this regulation.

Particulate Emissions from Refuse-Burning Equipment

It is recommended that emissions from this category of sources be limited to 0.40 pound of particulate matter per 1,000 pounds of stack gas (adjusted to 12 percent carbon dioxide), or the following particle count rate:

Particles* per minute	Condition
500,000	Residential areas
750,000	Commercial areas
1,000,000	Industrial areas
15,000,000	Public or privately owned, capacity 4,000 lb of refuse per hr or greater

*Particles greater than 20-micron diameter. Determination of emissions by particle count shall be made by the adhesive-coated paper method as described in the Incinerator Performance Ordinance of the City of Cincinnati (Ord. No. 485-1962, Section 2521-8 of the Cincinnati Building Code).

This regulation is in effect at the present time in the City of Cincinnati and the seven communities in the Intercommunity Air Pollution Control Program.

Opacity, Black Plumes

Density of black plumes should be less than No. 2 Ringelmann (as measured by the Ringelmann Smoke Chart), with 5 minutes of less than No. 3 in any hour allowed for normal operations of startup, fire cleaning, and flue blowing.

Opacity, Non-Black Plumes

Non-black plumes should be rated on an equivalent opacity basis and should meet the same requirements as black plumes. If an operator demonstrates, at his own expense, that emissions meet other applicable emission regulations, the equivalent opacity regulation should not apply. Plumes whose opacity is wholly due to water vapor should be exempted from this standard.

Sulfur Compounds from Process or Manufacturing Operations

Emission of sulfur compounds from this category of sources should not exceed 2,000 parts of pollutant per million parts of flue gas (0.2% by volume), except that this limitation should be lowered if it is shown that 2,000 ppm results in a violation of the air quality goal at the plant lot line. Conversely, the limitation might be raised for individual sources if it can be shown that the air quality goal is not exceeded by a higher emission.

Sulfur Compounds from Stationary Fuel-Burning Equipment

It is recommended that consideration be given to the development of a regulation for this pollutant emission, but no specific regulation is recommended here. The matter requires additional study of practical means for controlling the emission of sulfur compounds from fuel-burning operations.

Odors

The emission of odorous compounds from any source should be less than the quantity that results in a violation of the applicable air quality goal at the property lot line.

Open Burning

It is recommended that the program adopt a regulation to prohibit open burning with exceptions for those parts of the program region sparsely populated and sparsely industrialized.